Electronic Version
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Claims

[c1] 1. A method of removing a metal oxide from an alloy surface of an article, comprising the steps of:
(1) placing the article within a vacuum chamber,
(2) applying a vacuum within the environment of the chamber,
(3) generating a reductive plasma within the vacuum environment of the chamber, and
(4) exposing the alloy surface to the reductive plasma for a time sufficient to reduce the metal oxide.

[c2] 2. The method according to Claim 1 wherein the reductive plasma comprises a concentration of active H_3^+ ions.

[c3] 3. The method according to Claim 1 wherein the alloy surface further comprises at least one crevice having a surface comprising an metal oxide.

[c4] 4. The method according to Claim 1 wherein the vacuum within the environment of the chamber is sufficient to generate a meta-stable H_3^+ plasma.

[c5] 5. The method according to Claim 4 wherein generating the meta-stable plasma comprises using a plasma gen-

erator.

[c6] 6. The method according to Claim 4 wherein the vacuum within the environment of the chamber is about 20 torr or less.

[c7] 7. The method according to Claim 6 wherein the step (2) further includes the step of purging the environment of the chamber with a reducing gas prior to or during the applying of a vacuum.

[c8] 8. The method according to Claim 6 wherein the vacuum is about 10 to about 15 torr.

[c9] 9. The method according to Claim 4 wherein the step (4) comprises directing the meta-stable plasma toward the metal oxide.

[c10] 10. The method according to Claim 9 wherein the directing step comprises using a plasma torch, and positioning a discharged stream of the meta-stable plasma from the plasma torch toward the metal oxide.

[c11] 11. The method according to Claim 10wherein the plasma torch comprises a discharge nozzle, an electrode in non-contacting relation with the discharge nozzle, a source of a plasma-forming gas for passing through the discharge nozzle, and a power supply device for the for-

mation of a non-transferred arc between the discharge nozzle and the electrode.

[c12] 12. The method according to Claim 1 wherein a reductive plasma comprising a meta-stable H_3^+ plasma is generated from a plasma-forming gas comprising about 8% or less hydrogen gas, and a remainder of an inert gas.

[c13] 13. The method according to Claim 9 wherein the directing step comprises applying a reverse-bias voltage potential between the plasma generator and the alloy surface.

[c14] 14. The method according to Claim 12 wherein the directing step comprises passing the meta-stable plasma through a magnetically-generated channel.

[c15] 15. A method of removing a metal oxide from an alloy surface of an article, comprising the steps of:
(1) placing the article within a vacuum chamber,
(2) applying a vacuum of about 20 torr or less within the environment of the chamber,
(3) using a plasma torch to generate a concentration of active H_3^+ ion within the vacuum environment of the chamber, the plasma torch comprising a discharge nozzle, an electrode in non-contacting relation with the dis-

charge nozzle, a source of a plasma-forming gas for passing through the discharge nozzle, and a power supply device for the formation of a non-transferred arc between the discharge nozzle and the electrode, and
(4) positioning the discharge nozzle toward the article, to direct the concentration of active H_3^+ ion toward the metal oxide on the alloy surface for a time sufficient to reduce the metal oxide.

[c16] 16. The method according to Claim 15 further comprising the step of applying a reverse-bias voltage potential between the plasma torch and the alloy surface.

[c17] 17. An apparatus of removing metal oxide from an alloy surface of an article, comprising:
(1) a vacuum chamber,
(2) an active H_3^+ ion plasma generator, and
(3) a means for directing a generated H_3^+ ion plasma to the article.

[c18] 18. The apparatus according to Claim 17 wherein the plasma generator comprises a H_3^+ ion plasma discharge point positioned within the chamber.

[c19] 19. The apparatus according to Claim 17 wherein the plasma generator comprises a plasma torch comprising a discharge nozzle, an electrode in non-contacting rela-

tion with the discharge nozzle, a source of a plasma-forming gas for passing through the discharge nozzle, and a power supply device for the formation of a non-transferred arc between the discharge nozzle and the electrode.

[c20] 20. The apparatus according to Claim 19 wherein the plasma-forming gas comprises about 8% or less hydrogen gas, and a remainder of an inert gas.